

THE
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GENERAL REVIEWS AND SUMMARIES

THE RECENT LITERATURE OF MENTAL TYPES

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Phenomenal calculators have generally been regarded as members of a special mental class, but the analysis by Lahy (11) of the gifts and attainments of Mlle. Uranie Diamandi, sister to the Diamandi studied by Binet, leads to the conclusion that while the attainments of this calculator are considerable her natural gifts are not remarkable. Even in immediate memory for digits her ability is not abnormal. Her success is attributable to practice and to family influences together with an exalted faith in her own ability. The analysis of some of the working methods of phenomenal calculators by Ameline (1) shows that they are essentially primitive and involve no extraordinary processes. So far as extraordinary memory for numbers is concerned the work of Müller (12, 13) with Rückle likewise makes it seem probable that there is no typical difference between these rare performers and ordinary persons.

According to the objective psychology of Bechterew (2) the "mental class" of criminals is also a fiction.

The study by Seashore (16) of the mental make-up of the singer is typical of what seems to be a strong tendency away from the theory of mental types, with the attempt to define mental classes, and toward a more purely descriptive study of individuals through comparisons with established norms. On the other hand the doctrine of special types flourishes in the hands of certain popular writers whose work would not need mention here except for the wide publicity which it has received and the warm reception with

which it has met. According to these writers (3, 5) mental types may be judged and individuals given a mental classification on the basis of the appearance of their handwriting or the color of the hair and the "convexity" of the face.

Writers who are themselves of another (but sometimes not more psychological) mental type also make a serious business of the establishment of mental classes. For example Müller-Freienfels (14) proposes three categories each consisting of a pair of opposite types as a basis of classification which will hold alike for artists and thinkers. These categories are: *Speziellseher-Typenseher*, *Statiker-Dynamiker*, *subjective-objective*. In the mind of Kurella (10) the gifts of the artist and thinker are to be clearly distinguished from those of technical workers and men of affairs, and his whole discussion of mental heredity is based upon this distinction. Jung (9) traces a common thread running through several attempts at a dual classification of types—the *tender minded* and *tough minded* of James, Ostwald's *classicists* and *romanticists*, Worringer's distinction between *Einfühlungsdrang* and *Abstraktionsdrang*, the distinction by Schiller of *naïf* and *sentimental* and Nietzsche's *Appollonian* and *Dionysian*. The basis of all these distinctions is found by Jung in the tendency of some minds to direct their interests inward upon themselves (*intraversion*), while others turn outward (*extraversion*). It will be our future task to evolve a psychology which shall not be partial, as Freud's or Adler's is, to one or the other of these types.

Myers and Valentine (15, 18), in the course of an elaborate analysis of the attitudes which different individuals assume in æsthetic appreciation, note four distinct types: *Intrasubjective*, depending upon the feelings, feelings of self activity, etc. *Objective*, involving a comparison with the ideal, analysis of the objective characteristics of the color, tones, etc. Ascription of *character*, personifying, etc. *Associations* of various types. It is recognized that pure cases of any of these types are rare, but in the reviewer's opinion these types have at any rate the advantage of being based on experimental work, while much of the writing in this field is distressingly theoretical. The paper by Werner (20) can be held responsible for the last remark.

Thorndike (17) in the Cattell Festschrift discusses the present status of the study of gifted individuals of the scientific type.

A summary of investigations (with a bibliography of 29 titles) of the typical peculiarities of children in learning, memory, atten-

tion, ideation, suggestion and reasoning, is given by Howard (7). Jones (8) shows by a series of tests that there are enormous differences in ability between children in the same classes in school.

Married people are distinguishable as a class from unmarried people, particularly by their greater activity and their superiority in all intellectual endowments, according to Heymans and Wiersma (6). They use the results obtained on this point from their well-known questionnaire and argue from them for the effectiveness of natural selection in the mating of human beings at the present time.

The Heymans-Wiersma questions, together with the topics or questions proposed by Hoch-Amsden, Cattell, and Davenport, have been made the basis by Wells (19) of a set of questions along the lines of the unpublished Hoch-Amsden "Guide" so as to give what is by far the best available scheme for obtaining classified information through questions concerning an individual. It is held that "personality denotes an *ensemble* of characters." This set of questions will prove of great service to those who wish to discover what the actual characters are which enter into such an *ensemble* in any particular instance. A very similar aim is responsible for the proposal by Fuchs (4) that the characteristics of an individual be noted under the strain of reaction to concrete situations such as an earthquake or an insult. He would classify the reactions under four heads: Reflex or instinctive (including memory), apperceptive processes (thought, judgment, etc.), affective states, somato-physiological processes; and also from their social, non-social, or anti-social aspect.

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RIGHT AND LEFT HANDEDNESS

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Experimental work in this subject during the last two years has not been very extensive. Stevens and Ducasse (8) investigated for various positions in the field of vision the distances between the fixation point and a movable point in indirect vision, that were estimated equal to a standard distance from the fixation point, in the opposite radius. They found that, with a few exceptions, these distances are overestimated in the right half of the field of vision both by the right and left eyes. They conclude that objects in the right half of the field of vision, by thus appearing larger, "attract the visual attention, which in turn leads to grasping movements of the right hand. The hand thus favored by earliest experience acquires a special skill which causes it to be used in all manual acts requiring the greatest precision."

A patient, aged 42, always right-handed, who developed simultaneously *left* hemiplegia and complete motor aphasia is reported by Mendel (4). The lesion was an embolism in the fossa Sylvii of the right hemisphere. The patient was under observation for six

months, during which time a complete neurological examination was made and the history secured. Death ensuing, the autopsy was made and seems decisive.

Several similar cases are cited from literature, but the evidence of the lesion's being confined to the right side of the brain in right-handed aphasics is not always as good as that in the new case reported here.

Ramaley (7) reports a study of the inheritance of left-handedness, comparing his result with the Mendelian expectation. Only two generations are recorded, consisting of 610 parents and 1,130 children. When both parents are right-handed of families containing some left-handed children the proportion of left-handedness among the children is 45.67 per cent. The discrepancy between this and the Mendelian expectation (25 per cent.) is explained by supposing that many of the parents reported as right-handed are really left-handed. When both parents are left-handed (2 families, 7 children) one right-handed child and six left-handed children result. In order to make plausible the explanation that the left-handedness of one of these parents may have been acquired, the author suggests that "possibly some heterozygous (simplex) persons may easily learn to use the left hand."

The abstract of Meyer's paper (5), which was read before the American Psychological Association, asserts the primary left-handedness of infants. The following fact, to which Meyer's (6) attention was called by Professor G. V. N. Dearborn, is cited without references. The muscle fibers in the sartorius have been counted and found to be fewer in the right than in the left in the new born, and more numerous in the right than in the left in the adult.

Kipiani's paper (3) contains an extensive critical review of the previous work in the subjects of right-handedness, left-handedness and ambidexterity. The pedagogical implications are considered as well as the pathological etiology. Some original experiments in training for ambidexterity are reported and these show, especially in "mirror" writing, the development of great facility in the less favored hand. The article is of chief value as an abstract of literature. Ioteyko's (2) interest is pedagogical. She defends the greater use of the left hand by left-handed children on the ground that the same facility can never be developed in the right. Many reasons are given, however, for the training of both hands by symmetrical exercises. Brewster (1) has written an article containing no original matter but presenting many facts which might be of popular interest.

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VOLUNTARY PHENOMENA—EXPERIMENTAL

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Pupils of Ach have been engaged in the further working out of the experiment reported in his "Willensakt," with the particular object of obtaining quantitative objective demonstrations of the several factors which he found from his introspective observations to be important as helps or hindrances to the successful execution of a volition. Ach's method, it will be recalled, was first to form strong associations between pairs of nonsense syllables, and then to present the first members of such pairs with instructions to respond by syllables rhyming with those presented or by syllables having some other prescribed relation to the stimulus syllables. The prescribed (and intended) reaction would thus be different from that which had become strongly associated with the stimulus, and in overcoming the tendency to the habitual reaction the will would be strongly excited. In some of the present studies (4, 5) the method has been developed by the use of two-syllabled nonsense words, such as *golaf*, formed according to certain rules and specifications, in place of the syllables used by Ach. With these longer compounds a variety of operations could be prescribed, such as interchanging the two vowels, interchanging the first and last consonants, substituting for the middle consonant the consonant immediately following it in the alphabet, etc. The subject could then be trained in one form of reaction, and then shifted to another form to produce interference. Another improvement in method consists in replacing the "new syllables," which Ach employed for

purposes of control, by "neutral syllables," made thoroughly familiar by previous study in constantly varied combinations, so as to avoid any particular associations. The neutral syllables would thus not differ from the previously associated syllables in point of familiarity, but only in the absence of definite associations. (It should be remarked, however, that, under the conditions in which these neutral syllables were made familiar, they became distasteful to the subjects, and thus may well have acquired a disturbing quality quite as bad as the unfamiliarity which it was desired to avoid (Glässner, Rux). This could have been avoided by familiarizing the neutral syllables by aid of recognition experiments instead of by requiring them to be learned in combinations which were constantly changed.)

These papers are perhaps more important in point of method than in results. It is objectively demonstrated that an intended operation is impeded by contrary associations previously formed (reproductive inhibition—Glässner, Rux), and by the perseveration of contrary operations just previously exercised (perseverative inhibition—Wiedenberg). The reality of a reproductive facilitation of intended operations is similarly shown (Glässner). Ach's "law" that a specific task is easier of execution than a more generalized task receives confirmation, and "Jost's law" of the superior effect of distributed learning is shown by Wiedenberg to apply also to the perseverating tendency of an exercised form of reaction.

Rose (3), working in Störing's laboratory, reexamines with improved technique the latter's statement that unpleasant sensations have a positive dynamogenic effect. He replaced the hand dynamometer by a finger dynamograph or spring ergograph, and measured both the force of contraction and the latency or reaction time, both in neutral conditions and under the influence of strongly unpleasant stimuli. These consisted of strong vinegar, strong salt solution, and a mixture of these two. The outcome of a large number of trials was to the effect that these stimuli increased the force of voluntary contraction in 65 per cent. of the cases, and hastened the onset of the contraction (decreased the reaction time) in 73 per cent. Störing's statement was thus shown to hold good, though with exceptions. The author also examined the effect of the familiar sensory and motor attitudes of reaction time experiments upon the force of maximal voluntary contraction, and found that stronger contractions were obtained with a motor than with a sensory attitude, the "natural" attitude giving intermediate results.

An interesting observation is that of Abramowski (1), who finds that many persons are able to inhibit the "psychogalvanic reaction" at will. The stimuli employed were sudden light or darkness, noises, touching the head or shoulders, mental multiplication, and words for free association. The inhibition was seldom complete, and varied with the character of the stimulus and with the individual. The experiments so far reported are not numerous enough, however, to do more than make clear the general fact of voluntary inhibition. The inhibition seemed to the subjects themselves to be accomplished, in some cases by attending to something other than the stimulus, and in other cases by concentrating an intellectual attention upon the stimulus; but the author rejects these interpretations, and holds that the voluntary influence is probably exerted directly upon the cœnesthesia which lies at the basis of the emotions.

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DYNAMIC PSYCHOLOGY

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The reply of the foremost champion of introspectionism to Professor Watson's position appears in Professor Titchener's recent remarks before the American Philosophical Society (5). He points out that Professor Watson's views are but a rising again of what has before been crushed to earth in psychology. Behaviorism is logically "irrelevant" to psychology, since someone must still scrutinize what the behaviorist has ignored. "Science is concerned with empirical facts; and for the individual man of

science to 'insist' that certain facts of observation may be cancelled without loss to the science to whose subject-matter they belong is to incur, at the very least, the charge of a certain rashness of behavior." He questions the factual validity of Watson's generalization regarding the "fifty-odd years," and calls attention to the contributions to applied psychology from introspective sources. In regard to Watson's laryngeal and sex-organ criteria, "the 'required' peripheral changes are required—by the thoughts and emotions of an introspective psychology! . . . The confusion here is plain, and the critical point need not be further labored." The strongest point in the paper is the insistence that behaviorism shall not run with the hare of science and hunt with the hounds of technology. If it adheres to the most rigid standards laid down by Watson it will miss so much of the immediately practical that it can make no consistent claims on that score. The knowledge of the human mind that can be devoted to practical ends, which Titchener would formulate as a technology, must be drawn from both introspection and behaviorism.

The contest between these two modes of thought will probably go on, under one name or another, just so long as humanity feels the necessity of rationalizing its mental activities. But it does not give the ultimate causes of why one set of reasons appeals to the Titcheners and another set to the Watsons, which are, at least technologically, the most interesting of all.

A systematic account of recent studies in the physiological chemistry of the emotions is published by Cannon (3). He begins with a very necessary anatomical description of the autonomic nervous system. One may quote practically without change a number of sentences from his paper. Fear, rage and pain are accompanied by an increased discharge of adrenalin into the blood, and by a freeing of stored glycogen from the liver for circulation through the body as dextrose. Because the adrenalinæmia and the hyperglycæmia following painful or strong emotional experiences are reflex in character, and because reflexes as a rule are useful responses, we may reasonably inquire whether under these circumstances the increase of adrenalin and sugar in the blood is useful. The conclusion seems justified that the increase of blood-sugar attendant on the major emotions and pain, is of direct benefit to the organism in the strenuous muscular efforts involved in flight or conflict or the struggle to be free. The conclusion is warranted that adrenalin, when freely liberated in the blood, not only aids

in bringing out sugar from the liver's store of glycogen, but also has a remarkable influence in quickly restoring to fatigued muscles, which have lost their original irritability, the same readiness of response which they had when fresh. The absolutely essential organs, as well as the skeletal muscles, are, in times of excitement, when the adrenal glands discharge, abundantly supplied with blood taken from organs of less importance at critical moments. There is a considerable account of the antagonisms between the different divisions of the autonomic system. "Just as in times of war between states the arts and industries which have brought wealth and contentment must suffer serious neglect or be wholly set aside both by the attacker and the attacked, and all supplies and energies developed in the period of peace must be devoted to the coming conflict; so, likewise the functions which in quiet times support the bodily reserves are, in times of stress, instantly checked or abolished, and these reserves lavishly drawn upon to increase power in the attack and in the defense or flight."

"If various strong emotions can thus be expressed in the diffuse activities of a single division of the autonomic—the division which accelerates the heart, inhibits the movements of the stomach and intestines, contracts the blood-vessels, erects the hairs, liberates sugar, and discharges adrenalin—it would appear that the bodily conditions which have been assumed, by some psychologists, to distinguish emotions from one another must be sought for elsewhere than in the viscera. . . . For this reason I am inclined to urge that the visceral changes merely contribute to an emotional complex more or less indefinite, but still pertinent, feelings of disturbance, in organs of which we are not usually conscious. . . . Evidence from uniformity of visceral response and evidence from exclusion of the viscera are therefore harmonious in pointing towards central rather than peripheral changes as the source of differences in emotional states."

Benussi (1) reports a series of experiments in which the subject sat before a number of observers, and was given a card whose contents he must describe according to a standard procedure. The regular card was to be described correctly; but if it bore a red star in the corner, the description was to be falsified in every particular. The observers were to judge whether the description was correct or false. At the same time the breathing of the subject was recorded, and the records examined to determine if the breathing before and after the false descriptions differed in any characteristic

way from that before and after the correct descriptions. The essential relationship is the quotient of the inspiration time divided by the expiration time. Though there are individual differences, the reliability of the judgments of the observers as to the correctness or falsification of the descriptions is too small for significance. There appeared a somewhat greater tendency to take a correct for a falsified description than the reverse. The pneumograph records on the other hand show the phenomenon that the quotients *inspiration : expiration* before a correct description are greater than those after it; in the case of a falsified description they are less than those after it. That is, expiration is relatively more rapid after a falsified description. This is practically exceptionless. The capacity of the individual subjects for undetected falsification of their descriptions is also represented in their breathing curves. If, however, the observers knew that an incorrect description was being given and the subject knew that they knew it, the characteristic symptoms of falsification did not appear, but the breath curve was the same as for normal descriptions. The symptoms of falsification were not altered by voluntary effort to distort them. There appears here a possibility of determining lies in pedagogical and criminalistic fields. The observations are formulated as "*Die Atmungssymptome der Lüge.*"

"*Alles was man sagt, ist ein bisschen wahr*"; and it would be interesting to know if the method could be elaborated to give not only the fact of the lie, but an idea of its magnitude. An even greater possibility of usefulness would attach to it if one could thus determine, besides the lies one tells to others, also those that are told to oneself.

The almost uncanny tone of the psychoanalytic results with the association experiments is sustained in the study by Lang (4) of the comparative association types of dementia præcox cases and of their families. There were 47 subjects belonging to 11 families, in all but one of which the præcox cases were men; also two normal families of eight persons in all. The stimulus words were the regular 100-word series of Jung, whose system of classification was also followed in the quantitative treatment of the results. This was analogous to that in the study of Fürst, to which frequent reference is made. The case histories are given in detail, where the shut-in-personality plays a prominent part. Some show the precipitation of the psychosis when life demands from the patient a separation of the *Uebertragung* from its previous object, which

he is unable to make. "We are inclined to believe that a far-reaching correspondence in the (association) reaction type of two persons betokens a strong approximation of the one to the other, or what means the same thing, a strong and long-standing *Uebertragung*. It is also believed that a pronounced predicate type of association is symptomatic of inadequately sublimated libido, a finding that the reviewer's experiments would probably confirm. There are some data that seem also to confirm the idea of *Umkehrung der psychosexuellen Einstellung* put forward by Pfenninger, and previously noted in these columns. The variability of the association type is smaller in the dementia præcox families than in the normal, indicating that the latter are less susceptible than the former to the influences of the extra-familial *milieu*. The main result is that the dementia præcox case shows the closest approximation of association type to that member of the family about whom his delusions center. The dementia præcox case also has the smallest mean variation (*mittlere Abweichung*) from all other members of the family.

Bleuler has a rather condensed article on sexual resistances or negativism (2). The sexual instinct is especially distinguished from all others in that disproportionately great resistances are set against it,

"Die Schwierigkeit ist immer klein
Man muss nur nicht verhindert sein."

These resistances are shown for example in the artificial selections of totemism, and in the regulations of civilized society, which are so much opposed to the positive trend that in spite of all dangers they are continually transgressed. The quite instinctive identification of sexual intercourse and death brings it into conflict with the instinct of self-preservation. The valuation of chastity is partly an expression of this sexual negativism, which also brings about the conception of sexual intercourse as sin, that is, it can be dangerous for both individual and race. "Boundaries between the permissible and the impermissible are unknown to nature. Therefore, all enjoyment is not only something worth striving for, but also something harmful, in the moral sense a sin . . . and as it (sexuality) plays elsewhere the greatest rôle, so must it also be the most important factor in sin."

"This corresponds with observation. The sexual symbol, the snake, is at once the symbol of sin. Sexual asceticism is the most respected, and the most consequentially desired."

Man has an exceptional capacity for self-satisfaction in sexuality, and as this most directly endangers the continuity of the race, the most powerful resistances are built up against it, as is shown in the tendencies to concealment though the nature of the actions is not understood, as in the masturbation of young children. Again, pathological cases show very clearly that onanism is the *sin par excellence*. So many self-accusatory ideas are traceable to autoerotic complexes that they are unquestionably the greatest source of all pathological self-accusation.

By the mechanisms of autistic thinking, the resistances which inhibit onanism must also be spread out over the entire sexual instinct. The conclusion lies near that the essential factor in sexual resistances is the carrying over of the negative affect from onanism to sexual reactions in general.

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REACTION TIME

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Lyon and Eno's (5) interesting experiments show that if two electric or tactual stimuli of like intensity are applied at points eight inches apart—wrist and elbow—the stimulus at the wrist must be given one fortieth of a second before the stimulus at the elbow in order that the two sensations shall appear simultaneous to an observer. This would indicate a speed of the nervous impulse of ten meters per second which accords neither with the results of reaction time measurements nor with other experiments on the rate of the nervous impulse. Ten possible sources of error or explanations are discussed and dismissed with a conclusion that

since "when the two stimuli are so timed that the corresponding sensations occur simultaneously the correlative sensations *do not* occur simultaneously, it would seem to follow that in the case of sensation, at any rate, the cortical and psychic processes are not *synchronous*."

Kramers (4) gives detailed introspections for purposes of a descriptive analysis of recognition reactions to four-place numbers previously memorized. The groups of experiments consisted of simple reactions to known stimuli, simple reactions to unknown stimuli, and choice reactions to known stimuli with the thumb, to unknown with the middle finger, and to doubtful stimuli with the index finger, and the same series without reaction movements. In addition to the introspections and the time values, pneumographic and sphygmographic records were obtained in all cases.

G. R. Wells (10) studied the effect of five durations of auditory stimuli and five durations of illumination and darkness. The results "do not follow a rule analogous to Weber's law, as the results which Froeberg obtained apparently did. Nor is there any evidence of increase of reaction time with decrease of stimulus duration." In fact "the longer the duration of the stimulus the longer does the reaction time tend to be." The duration of an auditory stimulus within the limits of the durations used does not materially affect the reaction time. The reactions to visual stimuli showed no regular variations with the durations used nor with different individuals.

Salow (9), in a paper prepared by Dr. Klemm from Salow's tables and notes, reports experiments on sensory and motor reactions to visual stimuli with the right and left hands and with both hands simultaneously with pauses of 20, 15, and 10 seconds between the individual reactions. The left hand reacts more quickly than the right, especially in sensory reactions, both in reactions by one hand alone or by both hands simultaneously. The reactions by both hands are slightly longer than those by one hand. Other preliminary results on the influence of various conditions are also given.

Piéron (6) reviews in great detail the literature on the relation of stimulus intensity to reaction time and reports the results of experiments, most of which have previously appeared in the *Comptes Rendus*, with a considerable range of intensities of pressure, temperature, taste, sound and light from the threshold up. The results confirm Wundt's law that the time of reaction decreases

with the increase in intensity. The general formula expressing most nearly the curve of decrease is of the type

$$y = \frac{a}{x^\alpha + \frac{x\beta}{b}} + k,$$

where a represents the shortest time limit and k the difference between the shortest times and the longest times at the threshold. From this formula are derived specific formulæ for each of the senses.

Potter, Tuttle and Washburn (8) determined the average reaction times required to make judgments 'indifferent,' 'pleasant' and 'unpleasant,' 'very pleasant' and 'very unpleasant,' colored papers being the stimuli and the times measured with a stop watch. Ninety reactions were recorded for each of 55 observers. The average reaction times to judgments of extreme pleasantness and extreme unpleasantness were the same, 1.2 seconds or 1.3 seconds, to judgments of pleasantness about .3 or .4 of a second longer, and to judgments of indifference .3 or .4 of a second still longer.

Henmon and F. L. Wells (3) give evidence of marked individual differences in reaction time persisting after long continued practice. The simple reactions of one subject are after practice 20σ shorter than for the other, while his complex reactions are uniformly about 40σ longer. Individual differences are not reducible to direction of attention nor to practice as is not infrequently maintained.

Henmon (2) in the Cattell Festschrift, gives a general review of reaction time research with special reference to Professor Cattell's contributions in this field.

Piéron (7) discusses the relative values of the Hipp, d'Arsonval, and Ewald chronoscopes and suggests an improvement in the last named by using two independent circuits, one for the tuning fork and the other for the chronoscope, to reduce the strength of current required. This may best be done with a Guillet fork, or more inexpensively with a Bull fork, or even with a vibrating spring. The union of the Hipp chronoscope with the Bull apparatus would realize the ideal chronoscope.

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FATIGUE, WORK, AND INHIBITION

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The Effect of Physical and Psychological Factors on Fatigue.—Lee (24 and 25) points out that it is not, as so long held, the chemical properties of air, such as the presence of CO₂, or the lack of oxygen, that are important in the consideration of pure air but rather the physical properties such as heat and humidity. Humidity is classed here with heat as it too affects the true temperature of the body through its influence on the rate of perspiration. When the bodily temperature is raised there is an early oncoming of fatigue. This is caused by the addition to the normal fatigue toxins of other toxic products of abnormal metabolism. Cannon and Rice (4) find that adrenal secretion produces (1) an increase in blood flow, thereby lowering fatigue through (a) washing away fatigue products and (b) supplying nourishment, and (2) a facilitation of the passage of impulse from the nerve into the muscle. These effects are, however, too slight to account for the feats of strength which are performed in times of great excitement. Gruber (11) calls attention to the fact that increased blood pressure only increases noticeably the work done when the blood pressure is below 90 to 100 mm. of mercury. Small doses of adrenalin, he finds, cause a fall of arterial pressure, not a rise. When the fall is not below the above critical pressure of 90 to 100 mm. a betterment

in the height of contraction results; when below this zone the result is the opposite.

Effects of Fatigue on Physiological Processes.—Macdonald (27) and Glazebrook and Dye (8) are studying the heat production associated with muscular work and present a formula showing the relation between heat produced and the weight of the subject. Gruber (12) finds that fatigue increases the normal threshold stimulus—the amount depending upon the duration of work and the particular individual but not seemingly upon the amount of work done. Bose (3) working upon a plant reports a latent time of response of 0.1 sec. which is increased if the resting interval (20 to 25 min. between each excitation) is shortened. If it is shortened too much, the motile excitability is temporarily abolished. Langier and Richet (23) find professional work causes an increase in reaction time when the work period exceeds $5\frac{1}{2}$ hrs.,—the procedure was, however, not at all thorough. Amar (1) reports indications of fatigue as shown by (1) the pneumograph and (2) the pulmonary gaseous exchange.

Nature of Fatigue.—Ioteyko (20), while discussing pain and fatigue as psychical defenses to the organism, shows that Weber's law does not hold respecting them. In fact, according to her, sensations of fatigue increase geometrically while the stimulus is increased arithmetically. Fatigue has a noticeable effect upon the extent to which certain illusions of reversible perspective are seen, according to Flügel (6). From his study of these cases he decides that the fatigue is local and "highly specific in nature."

Physical Phases of Work.—A vegetarian diet seems to delay the onset of fatigue while meat diet increases the onset, according to Labbé (22), who also adds that the amount of food needed for efficient athletic work is not great. Roth (36) reports on a study of the weight of football men before and after practice, while Cook and Pembrey (5) report some results of study of "second-wind."

The Work Curve.—Maccagno (26) reports that such factors as voluntary effort, admonitions by experimenter, rest-pauses, etc., affected the amount of work done (adding) by two 10-year old girls, but they did not affect the type of curve—one having a descending and the other a flat curve. Hill, Rejall and Thorndike (18) report that they find no plateaus in two practice curves from typewriting nor any negative accelerations, and that evidently the old learning has a very great permanence even after $4\frac{1}{2}$ years. When 45 min. is divided up into $22\frac{1}{2}$, 15, 6, or 2 min. intervals and

used as drill periods in arithmetic in school the shortest interval is found to be considerably superior to the others when measured in the amount of permanent improvement. But as Kirby (21) has pointed out, this superiority may be due to the fact that the pupils have had greater opportunity to practice themselves outside of school.

Mental Fatigue.—Thorndike (39) has again emphasized the difference between the mechanical and biological theories of fatigue. In his *Educational Psychology* (40) we have an elaborate presentation of his views on mental fatigue which cannot be considered here for lack of space.

Fatigue in School.—Heck's monograph (17) has previously appeared in three installments (14, 15, and 16). The author concludes from a study of arithmetical tests upon 2,200 school children in school that if fatigue is present the amount is not enough to warrant any adaptation of school procedure to it. Martyn (29) found no consistent depreciation in various mental tests after school as compared with the early morning hours. In still another study (30) in which arithmetic tests were used the above was confirmed, but there was noted in addition some indication that fatigue caused a later appearance of the effect of *Anregung*. Safioti (37) reports that children from 5 to 9 years of age show the first signs of fatigue after writing ten minutes and that fatigue is markedly evident in twenty minutes. He presents a description of these evidences.

Fatigue in Industry.—At the 15th International Congress on Hygiene and Demography held in Washington in 1912 a great deal of interesting material was presented as to the effect of fatigue in industry. Only a few of the papers may be referred to here because of lack of space. Goldmark's plea for a scientific study of fatigue in industry ought not to be overlooked by psychologists (9). Franz (7) finds that "fatigue is evidenced by inaccuracies in movement, as well as by the lengthening of the time of movement and by a decreased performance of mechanical work," that "with increased speed, error arises, but the error increase is much greater than that of speed"; and that "changing the rate of movement increases the proportionate errors, making them greater than those when the speed is a constant, and decreasing the speed increases the proportionate errors, although not proportionately as much as when there is an increase of speed." Reid (33) and Robertson (34) find unmistakable evidence that there is a greater infant mortality

when mothers are engaged away from home than otherwise. But when the family is wretchedly poor, poverty is a more deleterious influence than when the mother is engaged in work away from home.

Rotch (35) and McMillan (28) call attention to the ill effects from monotonous industrial work upon children in that it overdevelops certain functions (often straining them) without developing others, which would be developed in normal play, while at the same time it has a markedly benumbing mental effect. Morton (31) again calls attention to the bad effects on women from long-continued standing and from severe muscular work. The pitiful noon-day lunch which the woman laborer can afford is also condemned. The psychological effects from noise especially on the inner ear are considered at some length by Blake (2). The indirect result of hard labor, White (41) claims, is shown in the marked increase of hysteria and neurasthenia. Williams (42) gives some account of the various occupational neuroses. Other factors considered by the Congress are: eyestrain, occupational diseases, caisson disease, smoke, pneumonia, heat and humidity (see Lee's articles above).

Inhibition.—Pawlow (32) reports a study of cases of the following sort. A tone of 1,000 vibrations will cause saliva to run in a dog. Upon adaptation the saliva ceases to appear. Then when a neutral stimulus (*i. e.*, having no effect on the salivary reflex itself), as an electric light flash, is given at the same time the saliva appears again. Shepard and Fogelsonger (38) find that if *a* and *b* have both been associated with *c* independently, when both *a* and *b* are shown together the reaction time in calling up *c* is very much longer than when *a* or *b* are shown separately. They feel that this type of inhibition cannot be brought under the ideas of drainage—that association cannot be explained as a mere path of lowered resistance—that association must involve other processes than those which prevent any other stimulus from using the same neurones at the same time, even when both stimuli would arouse currents which would naturally discharge over the same pathway. Having found that in a group of subjects the women were better in such tests as cancellation, color and form naming, directions, etc., while the men were better in the opposites, verb-object, agent-action, etc., tests, Haggerty and Kempf (13) conclude that the women's slowness in the second group is due to the suppression of many of the first responses that come to mind. The authors tentatively advance this greater tendency of women to be "on guard" against embarrassment as a phase of sex-differences.

Grassberger (10) presents some of the social implications of fatigue, as in daily life, art, poetry, etc. Hutchins's (19) paper is merely a review of the work of Goldmark's 'Fatigue and Efficiency' and Taylor's 'Scientific Management.'

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PSYCHOLOGICAL EFFECTS OF DRUGS

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No report on the effects of drugs was published for the year 1912, on account of the dearth of experiments which would be of interest to the psychologist. The present report includes the years 1912 and 1913.

The studies of alcohol occupy the most prominent place in the two years' work. Frankfurter (3) has studied the influence of alcohol, tea and coffee, on the speed and accuracy of work in type-writing. He failed to observe the elementary requirements of technique in drug experimentation, as all experiments were conducted upon himself as observer, and no control doses were employed. His results, however, accord with those of other workers. Alcohol (20 c.c.) decreases speed and increases the errors. The latter are said to be the result of false reactions. The chief difficulty is in the matter of visual-motor coördination. Tea (15 minutes brew of 20 gr. Ceylon) removes fatigue induced by preceding work, and also decreases the number of mistakes. Caffein (0.5 gr.) increases the amount of work done in a given time and decreases the number of errors.

Karlson (4) reviews 19 pieces of experimental work on the effects of alcohol on mental and muscular activity. He concludes that more experimentation is needed, on account of conflicting results. The review indicates to him that alcohol impairs every faculty more or less, the higher the faculty and the larger the dose, the greater is the effect. The impairment is one of quality rather than of quantity of work. The effect is cumulative and somewhat delayed. Great individual differences have been noted. Boos (1) discusses alcohol as a depressant rather than a stimulant. Although there is a brief stimulating effect upon some activities, it is so soon followed by a depression that stimulant is a misnomer. In many cases where stimulation seems to result it is really due to the depression of other related functions. Alcohol should be used therapeutically only where a narcotic is indicated and not as a stimulant.

Lillie (6) reviews the conditions and probable mechanism of anæsthetic and narcotic action. Stimulation requires variations of permeability on the irritable tissues. Anæsthetic effects seem to

be produced by modification of the semi-permeable membranes. This modification is of such a sort that the resistance of these structures to changes of permeability is increased. Loevenhart (7) points out that by using drugs which inhibit the oxygen-carrying power of the blood without interfering with the elimination of carbon dioxide, it is found that decrease of oxidation *per se* is responsible for the initial stimulation observed in asphyxia. Increased oxidation, secured by the use of certain derivatives of iodbenzoic acid, results in suspension of respiration, together with other evidences of depression of the central nervous system. Anaesthesia is a case of secondary depression resulting from decreased oxidation as opposed to depression from increased oxidation, which is probably the condition occurring in sleep.

Bush (2) investigated the effects of tobacco smoking on mental efficiency. Fifteen men were tested with a series of ten mental tests, "the method employed being similar to those used by Professor Thorndike and others." He found that tobacco smoking produces an average decrease in mental efficiency of 10.5 per cent. The greatest losses occurred in the fields of imagery, perception and association, that of the first being 22 per cent. Further, the effect was found to be due not to nicotine but to pyridine. The former was not found in the smoke of any tobacco except slight traces in cigarette smoke. The effect decreases with habituation. It is consoling to note that "the least effect was produced by the cheapest kind of tobacco."

Meier (8) investigated the effect of continued doses of bromides and chlorides upon the mental processes of epileptics. She criticizes previous tests as being too brief. Two epileptics who did not receive either drug were used as controls. Simple psychological tests, such as color naming, numeral naming, addition, learning nonsense syllables, etc., were used on account of the condition of the subjects. Six subjects were tested. Bromides caused a general decrease in efficiency and a quick onset of fatigue. There was a constant drowsiness and reduced accuracy of perception. The reaction time was decreased but the quality of the reactions was poorer. The effect on the memory varied; perseveration was common and a kind of aphasia appeared in some cases. Power of attention was considerably reduced.

Knauer and Maloney (5) describe the mental effects of the drug mescaline. Experiments were arranged for the purpose of getting some direct insight into the hallucinations of the insane. The drug

was administered to a number of physicians, who gave detailed introspective accounts of their experiences. The reports show that immediately preceding experiences have some influence on the nature of the hallucinations. Visual after-images, however, may be experienced independently of the visual hallucinations. The attention is narrowed but not to such an extent as in the hypnotic state. Sexual experiences were found to be a very unimportant factor in the content of the hallucinations. A full account of the experimental results is promised at a later date.

Poffenberger (9, 10) studied the effects of medicinal doses (1/20 to 1/30 gr.) of strychnine on two observers for a period of thirty days and on seven observers for a period of two days. The main purpose was to compare the effects of strychnine and caffeine. For this reason, the tests and the technique followed closely the plan of Hollingworth's work on caffeine. A multiplication test was added. The recognized sources of error in drug tests were carefully taken into account. No consistent physical symptoms were noted. The curves of work show neither an increase of efficiency nor a subsequent period of depression, although relapse after stimulation is usually given as one of the common characteristics of strychnine action. Poffenberger inclines to the view that, since strychnine acts predominantly on the lower centers of the nervous system, the mental processes should not be expected to show change. The only effect on muscular work would be a delay of the onset of fatigue. If this be finally shown to be the case, the action of strychnine must be considered markedly different from that of caffeine.

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FIVE YEARS OF PROGRESS IN COMPARATIVE MUSICAL SCIENCE¹

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The young science of exotic music is advancing at an accelerated pace. Nearly twenty-five years have elapsed since Benjamin Ives Gilman published the first phonographic study of primitive music; but within the last five years of this period, since the preparation in 1909 of Dr. Gilman's review and summary of the results achieved through the use of the phonographic method, the number of available contributions has doubled.

The leader in this forward movement is the talented director of the phonographic archives of the Psychological Institute of the University of Berlin, Erich M. von Hornbostel. To his scholarship and his industry during the past five years we are indebted for two clear and careful methodological studies in coöperation with Abraham (37, 44), and for incisive formulations of problems and results (49, 65, 73, 77), as well as for the actual transcription and analysis of melodies from many lands. His researches extend in geographical range over eastern and central Africa (45, 51, 76, 79), Madagascar and Indonesia (40), Bismarck Archipelago and the Salomon Islands (50, 68), Western Mexico (70) and Central Asia (57). The types of musical performance here exhibited range widely also over the different paths of musical evolution. To discover among such varied areas and types a few fundamental principles of musical experience, and at the same time to give a systematic account of the manner in which these principles have operated to engender among the races of men wide diversities of musical achievement, is a task which calls for penetrating insight as well as for patient accumulation of data.

In the task of transcribing, studying, and making available some of the phonographic data now to be found on the 6,000 cylinders of

¹ Read before the section for Ethnology at the Congress of the International Musical Society, Paris, June, 1914.

the Berlin archives, von Hornbostel has had among his collaborators Fischer and Wertheimer. Fischer has published an analysis of Patagonian phonograms (35), and a much more extensive study of Chinese records, vocal and instrumental (63). Wertheimer (46) has made a study of four phonograms from the Veddas of Ceylon, a short but extremely interesting contribution because it reveals in the music of these aborigines a type of song in some respects more primitive than anything previously known. Myers, of Cambridge University, has published a somewhat larger collection of Vedda songs (61), and also valuable researches on the songs of the Malu tribe of Papuans who are found in Murray Island, Torres Straits (66), and on the music of the natives of Sarawak, in Borneo (75). Myers's comparison and contrast of the music of these three peoples furnishes one of the best descriptions yet given of the early stages of the evolution of song (74). From the Vienna phonographic archives, Felber has issued a volume on the ceremonial recitations and songs whose intonation has come down through some three thousand years of Hindu practice from the period of the Vedas (67).

One of the finest studies issued during the recent period we are considering was made in Copenhagen by Thuren on phonograms gathered by Thalbitzer among the Eskimo of East Greenland (56, 59). All of the notes were patiently determined tonometrically. Every printed melody is preceded by a scale which exhibits exactly the intervals used, and which, by means of the conventional symbols prescribed by Abraham and von Hornbostel (44), tells at a glance many details about the characteristics of the song. In this respect Thuren follows von Hornbostel's suggestions even more closely than von Hornbostel himself has been doing.

This raises a very practical problem of method. To measure the pitch of every note is an inordinately slow and laborious task. Is it worth while? When one considers the wide range of inaccuracy of any singer, be he Cherokee medicine man or trained European vocalist, one wonders what value there can possibly be in measuring primitive performances with a fine scale, and in such great detail.

It is, I am willing to concede, a waste of time to measure with our present laborious tonometrical methods every note of every melody. But I want to seize this opportunity to urge the adoption of another ideal, that of publishing in full with every phonographic research a set of representative measurements. These measurements should be made in such a manner that they will exhibit the

range and the nature of *variability* of performance, as well as the typical performance. For example, Fischer (35, p. 942) gives us a table of measurements of two notes as they were sung by a Patagonian in nine different measures of a song. Each note has a variability exceeding a half tone. Wertheimer (46, p. 301) gives a sample set of measurements to show the maximal *accuracy* of Vedda intonation, but none to show the maximal *inaccuracy*. Here as elsewhere in the field of mental measurement it is important to know (1) the average, or central tendency, (2) the average of the deviations from this central tendency, and (3) the extremes of variability. Such information as this can be made available for purposes of comparative study if each investigator will publish, not necessarily all the measurements of all the notes used in all the songs, but all the measurements of the notes in a few selected songs. Particularly desirable are tabular comparisons of the intonations of the same motif when it is repeated several times in the course of a song, or in the same melody sung on different occasions by the same singer, and also by different singers. Such comparisons help in sifting out what is felt to be essential and what adventitious. Moreover, the index of variability may prove to be a valuable measure of one phase of racial musical development.

Let me hasten to add that the value of these data for comparative purposes will be greatly enhanced when we know more than we do now—which is surprisingly little—regarding the customary inaccuracy of intonation among trained and untrained singers of European music.¹

The late Frederick J. Burton devoted many patient years to the study of the songs of the Ojibway Indians; but we hesitate to include his volume entitled *American Primitive Music* (43) in our list of contributions to comparative musical science, because the standpoint from which he made his observations was frankly and explicitly not the scientific standpoint, but rather that of the musical composer in search of material. He used the phonographic method, but not to assist him in faithfully transcribing the sounds the Indians actually sang. He thought instead always to report what the singer meant to sing. In this application of what we may characterize as the interpretative or artistic method, as contrasted

¹ An important paper of W. C. Miles, "Accuracy of the Voice in Simple Pitch Singing," has appeared since this paragraph was written. Miles's research shows how valuable Seashore's tonoscope is, as a means of attacking these problems. His own contributions are mainly in the direction of standardizing tests and establishing norms. See *Psychol. Monog.*, 1914, 16, No. 69, 13-66.

with the scientific, Burton brought to his task the invalidating presupposition that the Indians really intended to sing intervals and sequences that conform to the musical ideals of our own European diatonic and harmonic standards. However useful his phonographic transcriptions may be as sources of thematic material for unresourceful composers, they certainly cannot be used by the scientific student of primitive music.

More objective, and hence more useful as scientific data, are the extensive records of songs of this same tribe, gathered, transcribed and analyzed in the two volumes by Densmore (52, 71). Sapir has transcribed for the University of Pennsylvania Museum and made available for study a selection of Creek and Yuchi songs gathered by Speck (60).

The problem of origins is a fascinating theme, as treated by Stumpf in his little volume on the Beginnings of Music (64). After pointing out essential inadequacies in the theories of Darwin, Spencer and Bücher, the author seizes the opportunity to present a convincing case for his theory that music had its first beginnings in the signal-call. What is the first differentia of speech and song? The voice in song assumes successively different levels of determinate pitch, while in speech the pitch is more indeterminate and continuously shifting. But when one calls loudly to a distant comrade, the voice tends to maintain one pitch, or to utilize in succession two or three distinct pitches. What is the primary desideratum in the way of musical capacity, without which no considerable development is possible? The ability to distinguish and utilize *consonant* intervals. The consonances of the octave, fifth, fourth and so on, were first forced into attention when groups of men and women became accustomed to unite their voices in prolonged signal-calls. Such is the kernel of the theory which Stumpf develops with skill, and buttresses with analogies discovered between certain very primitive songs and the calls of the Alpine yodlers. Then from these hypothetical beginnings in the midst of an impenetrable antiquity, he traces the course of musical development along the more easily discernable paths of later evolution. One chapter is devoted to primitive musical instruments and their influence, and another to primitive polyphony, rhythm, and speech song.

In the second half of his volume, Stumpf conducts the reader on a rapid circular tour through the whole realm of comparative musical science. He exhibits typical selections from the songs

that many hands have gleaned, points out the characteristic features of each, and indicates their significance for our conception of the development of music. A large fraction of the researches mentioned in the appended list have been levied upon for illustrative material, and in addition, several phonographic transcriptions made in the Berlin Institute are here published for the first time. Anyone wishing to digest the literature of comparative musical science may well take this volume as a first course after the *hors d'œuvre* of Gilman's review in *Science* (41), to be followed in turn by the solid research of Ellis "On the Musical Scales of Various Nations" (3), which ever since its epoch-making appearance in 1885, has supplied substantial pabulum for students with an appetite for exactness in musical investigation.

Gilman in this summary enumerated seven characteristics clearly revealed in exotic music: (1) Rhythmic complication; (2) Anharmonic structure; (3) Heterophony; (4) The isotonic scale; (5) The melody type; (6) Neo-tonality; (7) Pure song.

In the light of the newer and fuller information now available, what further can be said regarding these divergencies from European norms?

(1) Complexities of rhythm beyond the capacity of ordinary European musicians to duplicate or indeed to hear appreciatively, continue to come to notice. But in addition to these skillful products, are found many instances in which the rhythmical complexities are traceable not to a highly developed sense of rhythm but to a lack of it.

(2) The statement still holds that "as far as is known, true harmony does not exist outside of European music. . . . No peoples but the European have ever based an art of tone upon the disturbance and readjustment of consonant combinations of notes." But one of the gratifying achievements of recent researches, particularly those of von Hornbostel, has been the disclosure of various beginnings out of which harmony has grown.

There may be mentioned first of all the antiphonal singing of some of the Bantū cannibals of East Africa, in which the solo voice is found at the close of the stanza to overlap for a time the melody begun by the answering voices of the chorus. (A most unusual variant on this overlapping comes to light in the songs of the Ruanda, in which a systematic telescoping of the rhythmical figure results from the premature entrance of the antiphonal melody.) Secondly are found abundant instances of *bordun*, of vocal organ-

point, with the sustained tone sometimes above instead of below the melody; and not rare examples of ostinato, in which two or more of these sustained tones regularly alternate. Next should be cited the cases of organum, of singing a melody in parallel fifths or fourths, and much more rarely, in parallel thirds, sixths or even seconds. (The achievements of the Salomon Islanders in this respect are not without duplicate in contemporary Europe. The peasants of Dalmatia delight to sing in parallel seconds.) Yet another root of harmony is discovered in the widespread practice of heterophony, the simultaneous rendering of the same melody by different voices or instruments each in its own manner, with its own embellishments and variants. And finally, exotic music reveals traces of polyphony in the narrow sense, the simultaneous performance of different melodies which only now and then come into unison or consonance.

(3) Heterophony has been found in very simple and primitive music. It is by no means confined to the highly complex and elaborate orchestral performances of such oriental peoples as the Chinese.

(4) The isotonic scale. The prevalence in Java and Siam has long been recognized of music which uses not at all the diatonic, consonant intervals, but whose scale is constructed on the principle of tonal distance, by dividing the octave into equal steps. These forms of pentatonic and heptatonic scales are exotic but not primitive. Indeed they represent a very high degree of sophisticated development. The studies of primitive music, however, have also revealed the working of this principle of tone-distance sometimes side by side with the principle of consonance. In the songs of the Veddas, tone-distance is the only determiner of the size of the small melodic steps they use. In Sarawak, where a few of the larger consonant intervals are employed, the smaller intervals are apparently formed through dividing these larger intervals into equal parts. The tuning of the pan-pipes brought by Koch-Grünberg from Northwest Brazil apparently rests upon a similar combination of guiding principles. Tone-distance, so little in evidence in our own musical consciousness, seems to be widespread where the principle of consonance is not completely entrenched.

(5) Nothing new has been brought to light regarding the little understood Hindu raga or melody type.

(6) Neo-tonality. Fresh instances have been accumulated where (a) the first and highest tone in the melody is the keynote

and the final tone; (*b*) where the lowest pitch to which the melody gravitates functions as end tone, and (*c*) where the chief tone apparently coincides with neither the first nor the last tone of the melody. A fresh lesson in caution in this connection comes from von Hornbostel's observation that songs of the Kirghiz hordes of Central Asia, although they are made up of diatonic intervals, cannot be classed as either major or minor; for in different repetitions of the same melody, they interchange the crucial major and minor thirds indifferently.

(7) Of pure song, that is, of melodies unfettered by the restrictions of scale, the Eskimo melodies of Thuren may be cited as new instances; and indeed, from one point of view, most of the material gathered from tribes that have no musical instruments will be seen to be of this sort. The primitive musician does not have in mind a limited group of pitches within which all of his melodies must take their course. The interval is not the mental unit with which he works. His unit is the motif. As a song advances, a given motif may be transferred to new levels of pitch, but it retains its form, its integrity, its unity. This transposability of the motif is one of the more significant facts which the recent researches have brought into prominence; for it has varied bearings, not merely on these music-theoretic points regarding the priority of song over scale, but also on psychological problems regarding the nature of form, of *Gestaltsqualität*.

The psychologist will be interested in the growing knowledge of primitive music, chiefly because of the accumulating light it throws on certain mooted questions in audition, for example, the nature of consonance. Two tones whose vibration ratios are relatively simple are consonant. Is this characteristic, which makes them blend or fuse in consciousness, due simply to the presence or absence of such secondary phenomena as beats, which arise only when two musical sounds whose vibration ratios are not simple, are produced simultaneously? Or are the characteristics which make clangs consonant or dissonant, primary characters which can be perceived in successive tones of a melody under circumstances which preclude the possibility of beats and other secondary criteria?

I doubt if anyone who is familiar with the literature of primitive music will care to maintain the former alternative. The use of the octave, the fifth and the fourth is too well-nigh universal, even among most primitive peoples who have no musical instruments, and whose songs are purely melodic. Sabine (38), indeed, at-

tempted in 1908 a rehabilitation of the original Helmholtz theory that dissonance is due to the presence of beats and consonance to their absence. Sabine's main contention, however, is not for the beat-theory of consonance, but for a theory of the physical environmental conditions under which the phenomena of consonance led to the evolution of our musical scale. His researches within the field in which he has achieved eminence—the acoustic properties of halls and of building materials—forced strongly upon his attention the fact that when a melody is sung within the walls of an edifice the successive sounds overlap for a brief period, the length of which varies with the dimensions of the room and with the sound-absorbing properties of the materials of which the walls are made. Hence his hypothesis of the origin of a musical scale whose melodic intervals have simple vibration ratios: the perception of consonant or dissonant relationships between successive notes of a song became increasingly possible as songs were sung in buildings, large dwellings, halls and temples.

Sabine has done a service in calling attention to the share which this environmental factor may have had in facilitating the progress of musical evolution in Europe. But to view it not as a minor accessory factor but as the primary factor, one must turn his eyes away from the accumulated evidence of musical ethnography. Practically the only definite ethnographic statement Sabine makes is the following: "Almost no traveller has reported a musical scale, even of the most primitive sort, among any of the previously unvisited tribes of Africa" (p. 847), a statement peculiarly inapt, inasmuch as it is among the savage tribes of German East Africa and the Congo that there have been found the most obvious instances anywhere discovered as yet, of the early stages of the development of harmony. If there is one point in which the native Africans are not inferior to primitive peoples of other lands, it is precisely in this matter of a consciousness of relationships of consonance and dissonance, and the appreciation of their use in polyphonic singing.¹

¹ Sabine chose also to ignore the acoustical researches of Stumpf and other psychologists, which some students of audition supposed had long ago made Helmholtz's beat-theory of consonance untenable. As samples of the considerations Stumpf has advanced, let me here cite but two. If two dissonant tones of light intensity are conducted, one to the left ear and the other to the right ear, in such a manner that it is impossible for them to produce beats, the resulting clang does not lose its dissonant character. Moreover, if two musical sounds which form a consonant clang are made rough through the production of imitation beats, the beating clang does not become

Our attention throughout this survey of recent contributions to comparative musical science has gone mainly to those aspects which are of interest to the psychologist, to the acoustician and to the student of musical theory. This accumulating literature is of even greater interest to the ethnologist; for it will eventually give him an acquaintance with primitive culture as it expresses itself in song, comparable in adequacy with his present excellent knowledge of primitive graphic and plastic art.

In the matter of tracing cultural contacts and ethnic relationships by means of musical criteria, little has been done as yet; but what has been attempted, strikingly claims attention. I refer particularly to the evidences of contact which von Hornbostel (62) has found between regions as remote as the Salomon Islands and northwestern Brazil; and again, between Burma and Africa. At least one reviewer (72) of this ethnographic research has been impressed, not merely by the evidence itself, but by the penetrating analysis of general principles which guided von Hornbostel in the formulation of criteria for evaluating evidences of cultural contact.

Ethnologist, psychologist, *Musik-theoretiker*, each may share in the ripening harvest of comparative musical science. Others, too, may profit if they glean this field. No unsuperficial survey of the music of other lands and races can fail to increase one's catholicity of judgment, and to shatter one's provincial conviction that the only true God-given music must be cast in our own diatonic modern-European mould. No serious pondering of the rich accumulations of exotic music can fail to give a truer and more vivid insight into the little understood music of our own spiritual ancestors, particularly the mediæval musicians and the Greeks.

dissonant, but retains its consonant character. Beats are not essential to dissonance, nor the absence of beats to consonance; and the amount of the roughness produced by the beats of the partials of a dissonant clang is by no means always proportional to the degree of dissonance of the clang.

A SELECTED BIBLIOGRAPHY OF COMPARATIVE MUSICAL SCIENCE TO 1914

In the choice of titles, it has been the aim to give a complete list of first-hand studies of exotic music made with the aid of the phonograph; to include a selection from among the more reliable of the collections of materials made without the aid of phonographic control; to add related researches on pitch measurements of primitive musical instruments; and finally to mention the articles in which from time to time the results of these various investigations have been gathered together, their theoretical problems attacked, or their significance indicated for students of musical science, ethnology and psychology. No mention has been made of the phonographic studies of folk-music, a closely related field of rich promise.

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SPECIAL REVIEWS

Il Methodo degli Equivalenti. Contributo allo studio dei processi di confronto. A. GEMELLI. Florence, 1914. Pp. 344.

This book is undoubtedly one of the most important experimental researches in the psychophysics of touch which has appeared for some time. Dr. Gemelli has measured the equivalence-ratio for several parts of the body in pairs, under varying conditions which are faithfully reported. The equivalence-ratio is the ratio between two distances defined by the points of æsthesiometers which when applied to two parts of the body appear to be equal. Further Dr. Gemelli has based on the introspections of himself and of his subjects a careful analysis of the mental processes involved in making the comparison between two such distances. In respect of this experimental work and this analysis the book is an excellent addition to the literature of the subject, and one which should be added to every psychological library. It is to be regretted however that Dr. Gemelli has not confined himself to a clear statement of the results of his work in these respects, instead of indulging in philosophical discussions on the possibility of mental measurement, the nature of the so-called method of equivalence, and the like, which obscure the real value of his work.

The style of the book calls for some remark. The lucidity of the Italian is most refreshing in contrast to the numerous quotations in ponderous German. But the pleasure of reading is marred by the extraordinary and reprehensible frequency of misprints. It is not right that a work with the *cachet* of the laboratories of Bonn and Turin should have been allowed to appear in this condition. Nor are the mistakes all mere sources of amusement; some are such as possibly to lead to error. The description of Tables 7 to 26 which is given on page 84 is in two points inconsistent with the tables inasmuch as (1) the last column of those tables is incorrectly stated to contain mean values of equivalence-ratios and the mean variation thereof and (2) the final mean variation given at the foot of each table is in the description said to refer to the variable distances whereas in the tables themselves it apparently refers to the final value of the ratio, and this view is confirmed by Table 28. In Table 7 the final value 1.82 for the

ratio is surely a miscalculation or a misprint, and reappears in Table 28. The diagram in page 79 seems to contain some error. It succeeds in obscuring a perfectly simple process, for in the diagram as described on page 80 neither series is descending. These are only some of the errors easily found by a casual reader.

The method of experimenting followed by Dr. Gemelli is that known as the form G 1 of the Method of Equivalence. Consider the two parts of the body to be compared. A constant distance N was applied to one of them, and a variable distance V to the other. Later N was applied to the second and V to the first. The distances were not applied simultaneously but consecutively, separated by a pause. In some series N preceded V , in others it followed. Clearly the order of succession of the variable stimuli V might have been either irregular or consecutively ascending or descending. For reasons which do not appear to us convincing the latter form was chosen. In the first place this procedure makes the influence of suggestion and anticipation very difficult to ignore. Experiments performed with irregularly varying stimuli are much more reliable. Of course for Dr. Gemelli's purpose, the introspective analysis of the mental processes involved, one plan is as interesting as the other.

In the second place the way in which these ascents and descents were handled implies a mathematical process of calculation to which the present reviewer has elsewhere applied the same Limiting Process, and it is not the least of the services which Professor Urban has rendered to psychophysics that he has fully shown the mathematical connection between this process and others. Dr. Gemelli however does not seem to recognize the limitations of this plan, or at any rate he does not refer in any way to them in his book. Indeed his Chapter 4, on the mathematical treatment of the results, is most unsatisfactory, in particular with regard to what is said about the Gauss-integral. Possibly the author was well advised not to use this integral. But it is not true as he asserts that its use would have been wrong. The argument on which Dr. Gemelli incorrectly bases his rejection of the Gauss-integral simply asserts that if we know that a certain stimulus produces the same proportion of answers *two* on two regions, we still cannot say that the sensitiveness of these regions is the same, by which Dr. Gemelli here apparently means that they have the same threshold. But it is difficult to know how we can come to have this piece of knowledge without knowing something about other stimuli on each region, and then we can calculate L_1 and L_2 , S_1 and S_2 .

There are two ways in which we can imagine a Gauss-integral being used in these researches. (1) The S and L of each region might be given as a short way of defining the proportion of answers *two* to be expected at each stimulus. The ratio of two distances which gave the same proportion would of course not be the same throughout the scale unless L was inversely proportional to S . A knowledge of these ratios would be most interesting for comparison with the equivalence-ratios as defined by Dr. Gemelli which are something quite different. (2) The Gauss-integral might have been used in finding the points of subjective equality to each standard. In neither case is Dr. Gemelli's argument significant. There is no *a priori* objection whatever to any psychometrical function, and experience shows that the Gauss-integral is so far the best tried. The plan of calculation which the author finally adopts is commendably simple, and probably serves his purpose quite well. It would have been much improved by the use of the standard deviation instead of the mean variation. Our present criticism is directed not against the plan adopted but against the often incorrect discussion of the possible plans which were not adopted.

The chief experimental fact proved by this research is the dependence of the equivalence-ratio on the absolute value of the stimuli which are judged equal. The equivalence-ratio is greatest for small stimuli near the threshold of the less sensitive of two organs compared, decreases with the increasing stimulus to a minimum, and then increases again to the largest stimuli which could be employed. An exactly similar curve is obtained in the research on lifted weights which is briefly described in an appendix. The result differs from that of Camerer in giving larger values for the ratios, and from those of Camerer, Washburn and others in discovering the minimum which these experimenters did not reach. If this minimum is confirmed it is to be hoped that Gemelli's name will be given to the law.

It is here that the lack of statistical precision in giving the results is most felt. Not that there is much doubt of the significance of the result, for the unanimous agreement in this point of table after table shows that it is not likely to be due to chance sampling. But it is in searching for a reason for this equivalence law of Gemelli that one feels the need of more accurate statistical information.

For the far reaching effect which this research will have on the question of mental measurement, if it be confirmed by other experi-

menters, must be noted. We do not consider that Dr. Gemelli makes this at all clear. Take as a concrete example the comparison between the arm and chest of subject 1. The spatial threshold of this subject for the arm is 4.05 cm., for the chest 4.65 cm. Yet we can conclude from Dr. Gemelli's other numbers that a distance so about 3.8 cm. on the arm, which is usually felt as one point, if judged to be longer than about 5 cm. on the chest, which is usually felt as two points. If this be really so it is very interesting and important and would make mental measurement by threshold units a thesis very difficult to support. It would show that the psychological conditions of a threshold experiment (in which a sensation is compared with a memory of *twoness*) are so different from the conditions of a comparison or equivalence experiment (in which a sensation is compared as to its length-significance with the corresponding quality of a recent other sensation) that no consistent relationship exists between the results obtained in the two experiments.

In all this it must be kept in mind that we are discussing averages, average thresholds and average points of subjective equality. The average threshold is the point where the probability of an answer *two* is 0.5. What we should have liked to know and what Dr. Gemelli does not give is the probability of an answer *two* at each of the distances used (see page 436 of this review). Then quantitative accuracy could have been given to such statements as that made above that certain distances had *not usually* the quality *twoness*. This information would have enabled us to surmise to what extent the probability of *twoness* in a distance changes as it is considered in isolation or in comparison, and also would have permitted an accurate discussion of the error which seems to us to be inherent in the G 1 form chosen by the author.

This G 1 method was permissible for Fechner, who did not know that the equivalence-ratio varied with the distances used, but is not for Dr. Gemelli: for what it does is to measure in two different parts of the scale and then compound these two measures of different things into one ratio.

Of course even the G 2 method, although an immense improvement, does not entirely remove the difficulty. But the difference would not be great and probably further refinements are inadvisable.

One more point deserves mention before we leave the statistical side of the research. The results given by the plan of using ascents and descents have been conclusively shown by Professor Urban

to depend for mathematical reasons on the size of the steps used. Now in this research half centimeters were always used. That is, the steps bore a changing proportion to the standard, were comparatively small for large standards and vice versa.

We turn next to some of the side issues of the book, which are so numerous that we must select only a few for mention. The eighth chapter of the second part, on the influence of attention on the equivalence-ratio, is interesting. The author refers to two previous researches, by Binet¹ and Michotte² respectively, which contradict one another, inasmuch as Binet concludes there is no evidence of any modification in the threshold due to the influence of attention, while Michotte on the other hand found that in a state of inattention the threshold became about one sixth larger.

Gemelli makes a careful analysis of the meaning of the ambiguous word inattention, and distinguishes between inattention which is intense attention to something else, and that which consists in a distribution of diluted attention over a wide field containing many objects one of which is the object under discussion. The regions employed were the forehead and forearm, and he found that the equivalence-ratio was decidedly increased by thus diffusing the attention. The author is concerned throughout only with the actual value of the equivalence-ratio, not with the respective accuracy with which it can be measured in the different states of attention, although as far as can be gathered from the unsatisfactory measures of scatter which he gives there does not appear to have been much difference in this respect. The present reviewer's own experience in this matter has been that the threshold becomes more variable when great attention is given, rather than that any change in its absolute value occurs.³

The remaining experiments in the chapter are concerned with the equivalence-ratios between certain regions of the hand. The results are consistent with the former. The issue is here however confused by the references to Michotte's theory of "les signes regionaux" which is not very relevant to the present question; and which is stated in a somewhat incoherent fashion by Dr. Gemelli, who says on page 181: "tutti i punti situati all' interno di una regione hanno un medesimo segno," which does not seem to be the same as what appears to the present reviewer to be a more accurate

¹ Recherches sur la sensibilité tactile, *Année psychol.*, 1900.

² *Les signes regionaux*, Louvain, 1905, p. 64.

³ See *British J. of Psychol.*, 1912, 5, pp. 238 and 241.

statement on page 189, that in any one region "la soglia spaziale e espressa dalla medesima cifra."

Apart from the consistency of the experimental results illustrating Gemelli's law, the other chief point of interest in this research is the combination of experimental and introspective methods. To this introspective analysis, carried out in the spirit of the school of Külpe, is devoted the third part of the book. The process of comparison is divided into six stages, namely, (1) preparation, (2) appreciation of the first stimulus, (3) pause, (4) appreciation of the second stimulus, (5) formation of the judgment, (6) expression of the judgment. To each of these a chapter is devoted, and of especial interest is the discussion of what goes on during the pause, to which great importance is attached. The function of the pause is twofold; it permits the subject to reflect on the first stimulus, and to project his attention towards the second stimulus. Since he knows that the variable always changes by a half-centimeter, the subject often begins to form his judgment and occasionally even pronounces it before he has experienced the second stimulus. In certain cases the subject has a projection of the first stimulus on to the second region. This happens in various ways: one subject imagines the parts of the body brought into juxtaposition, another imagines the first æsthesiometer applied to the new region, others transport the distance itself in other guises. All this has a bearing on chapter 7 of the second part in which the influence of the visual imagination is discussed. It appears to us a mistake to separate the introspective work so completely from the rest of the book. In the case of the chapter on visual imagination referred to, some introspective evidence is certainly necessary to support the author's hypothesis that the differences in judging tactile distances on the arm for different positions of the latter are due to perspective foreshortening of the visual image formed.

Finally, the influence which Dr. Gemelli (rightly we think) attributes to the *Aufgabe* must be briefly referred to. This appears to us to be excellently illustrated by the difficulty raised in an earlier paragraph of this review: for when the direction to the subject is the detection of *twoness* in a tactile sensation the results obtained are inconsistent with those reached when the comparison (as to length) with another tactile sensation forms the *Aufgabe*.

GODFREY H. THOMSON

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Ancient Rome and Modern America: A Comparative Study of Morals and Manners. GUGLIELMO FERRERO. N. Y.: Putnams, 1914. Pp. 352.

America is taken in this book less for itself than as a symbol of the modern industrial age, the age of steam and electricity, of rapid production and consumption, when the bounds that were formerly set to human activity, enjoyment and thought are swept aside, and no limits are longer admitted, when the ideal of unlimited "progress" is the controlling force. The author, in visits to South and North America, was much puzzled by this ideal of progress, which at first seemed to him simply a struggle for unlimited wealth. Finding, however, that the increased wealth did not yield greater personal enjoyment, while still the people pursued their ideal of progress, he finally concluded that progress meant, at bottom, accomplishment, the conquering of new lands, the subjection of nature by the agencies of science and machinery. In short, the ideal of the present and coming age is quantitative, whereas the ancients, extremely limited in material resources as they were, accepted their limitations, and adopted an ideal of qualitative perfection. Only by thus accepting limits and striving for quality can a civilization rise to the dignity of high artistic production; and the cause of the low state of the arts in modern civilization is thus laid bare. The quantitative ideal has so strong and increasing a hold of Europe and America that there is no prospect of conditions favorable to art—and with art should be classed religion and all higher spiritual disciplines. No doubt, many individuals, having amassed wealth that they can not utilize in mere quantity of consumption, do and will seek for objects of qualitative perfection—as, for example, they seek to acquire famous paintings and other antiques. But this demand is not great and continuous enough, and does not pervade civilization to a sufficient degree, to call forth new art. Hence it appears probable that the ineradicable human impulses towards beauty and all forms of qualitative perfection, not meeting with satisfaction, will more and more lead to disillusionment. The future seems to hold in store, for Europe and America alike, a continued increase in wealth and mastery over nature, along with a gradual loss of the higher satisfactions of life and a consequent growth of pessimism. This then is the conclusion that is forced upon the author by contrasting ancient and modern civilizations. There are also certain parallels between the decline of the ancient civilization and the tendencies of our own

times, especially an excess of urbanization, and a decrease in the fertility of the human species.

The book makes interesting reading; whether solid or not is a question that can not be argued in brief compass.

R. S. WOODWORTH

COLUMBIA UNIVERSITY

The Instinct of Workmanship. THORSTEIN VEBLEN. N. Y.: Macmillan, 1914. Pp. 355.

This work will be of interest to those concerned with the relation of the individual to industry, culture and social institutions. The author begins with a defense of the traditional use of the term "instinct" as a convenient designation of certain large groups of specific reaction tendencies related to each other from the point of view of their teleology. The instincts, as thus described, assign the ends of life and determine the direction of rational endeavor and expedient. The parental bent, idle curiosity, and the sense of workmanship, among these proclivities, are of special importance in determining the development of technical, cultural, industrial and institutional structures. The manifold inter-relations and "contaminations" of these tendencies are presented, their characteristics and behavior described, and their useful and retarding influences elaborated. "The instinct of workmanship brought the life of mankind from the brute to the human plane, and in all later growth of culture it has never ceased to pervade the works of man." Instinctive propensities not directly related to this sense may nevertheless be seen to count materially in shaping the technological equipment of ideas and may even deflect the sense of workmanship from the pursuit of material efficiency. The latter propensity, in turn, reacts on strivings of a different sort and determines in various and often in hindering ways "the texture of the technological system." Thus the instinct of workmanship, through the sentimental propensity to attribute workmanlike qualities to material and implements, impedes the progress of the mechanic arts through the medium of anthropomorphic magic.

The major portion of the book deals with social rather than with individual themes,—the savage state of industrial arts, the technology of the predatory culture, ownership and the competitive system, the era of handicraft, machine industry, etc. But the whole discussion is intended to hinge on the leading proposition that for the individual human being "efficient use of the means at hand and

adequate management of the resources available for the purposes of life is itself an end of endeavor, and accomplishment of this kind is a source of gratification." In fact, habitual attention to technique is often seen to put the original motive in the background and the implements of labor become in themselves the end of endeavor. As is common in sociological exposition, there is throughout the book a tendency to mistake convenient historical description for adequate psychological explanation, and to confuse the conceptualized forms of behavior with its causal mechanisms.

H. L. HOLLINGWORTH

COLUMBIA UNIVERSITY

Outline of a Study of the Self. R. M. YERKES and D. W. LARUE. (Rev. ed.) Cambridge, Mass.: Harvard Univ. Press, 1914. Pp. 24.

The authors have revised the edition printed in 1913 (reviewed in the BULLETIN in January, 1914), but the changes are unimportant, consisting chiefly in the omission of a few redundancies and the addition of a few references. The *Outline* should stimulate and aid the systematic study by many a psychological reader and student of his own individual psychology.

M. W. CALKINS

WELLESLEY COLLEGE

BOOKS RECEIVED

CALKINS, M. W. *A First Book in Psychology.* (4th rev. ed.) New York: Macmillan, 1914. Pp. xxi + 428.

BINET, A. & SIMON, T. *Mentally Defective Children.* (Tr. by W. B. Drummond.) New York: Longmans, Green, 1914. Pp. xi + 180. \$1.

ROBINSON, L. *Marching Men, or Facing Problems of Childhood, Pulpit, and Pew.* Boston: Sherman, French, 1914. Pp. 243. \$1.25.

HOLLINGWORTH, H. L. *Outlines for Experimental Psychology.* New York: Seiler, 1914. Pp. 109. \$1.

HOLLINGWORTH, H. L. *Outlines for Applied and Abnormal Psychology.* New York: Seiler, 1914. Pp. 20. 25 cents.

SHEPARD, J. F. *The Circulation and Sleep. Experimental Investigations Accompanied by an Atlas.* (63 plates.) (Univ. of Mich. Studies, Scientific Series, Vol. 1.) New York: Macmillan, 1914. Pp. ix + 83.

MÜNSTERBERG, H. *Psychology and Social Sanity.* New York: Doubleday, Page, 1914. Pp. ix + 320. \$1.25.

NOTES AND NEWS

DR. E. P. FROST, of Yale University, has been appointed professor of psychology at the University of Tennessee.

DR. GARDINER C. BASSET, of the Carnegie Laboratory of Evolution at Cold Spring Harbor, has been appointed professor of educational psychology at the University of Pittsburgh.

THE daily newspapers have announced the death of August Weismann, the distinguished zoologist of Freiburg, at the age of 81.

ANNOUNCEMENT is made of the inauguration of a Post-Graduate School of Neurology in connection with the Philadelphia General Hospital. Courses will be given similar to those of the foreign neurological clinics and laboratories.

THE Southern Society for Philosophy and Psychology will hold its annual meeting in Philadelphia during convocation week.

THE twenty-third annual meeting of the American Psychological Association, under the presidency of Professor R. S. Woodworth, will be held December 29 to 31, at the University of Pennsylvania, in affiliation with the American Association for the Advancement of Science and with the Southern Society for Philosophy and Psychology. Arrangements are pending for joint sessions with sections L and H of the A. A. A. S. and with the Southern Society.

A MEETING of the New York Branch of the American Psychological Association, in conjunction with the Section of Anthropology and Psychology of the New York Academy of Sciences, will be held November 23. The following papers are announced: W. P. Smith, Some Aspects of Emotional Reactions; G. C. Myers, Motor-Emotional Expression of an Infant; H. L. Hollingworth, The Logic of Intermediate Steps; R. H. Paynter, Experiment vs. Court Decision; C. H. Bean, Demonstration of Psychological Apparatus.

PROFESSOR G. M. WHIPPLE has resigned his position as assistant professor of educational psychology in Cornell University and has accepted the appointment of associate professor of education at the University of Illinois.

THE following items have been taken from the press:

At the George Peabody College for Teachers a building for the Jesup Psychological Laboratory, to cost about \$75,000, is in process of construction.

DEAN A. WORCESTER has been appointed associate professor of psychology at the University of New Mexico.

DR. THOMAS A. LEWIS has been appointed professor of psychology and education at Denison University.

DR. TRUMAN L. KELLEY has been appointed instructor in the philosophy of education at the University of Texas and will have charge of a psychological clinic which is to be established by that institution.

EDITORIAL ANNOUNCEMENT

The plan for a new *Journal of Experimental Psychology*, outlined in the February BULLETIN, has met with a most favorable reception. The Editors of the Review Publications have accordingly determined to proceed with the enterprise. It was intended to start the new *Journal* in February, 1915, but the present abnormal situation in the scientific world abroad makes it advisable to postpone the first issue till more normal conditions prevail. The exact date will be announced later.

To relieve the crowded condition of the PSYCHOLOGICAL REVIEW part of the PSYCHOLOGICAL BULLETIN will be devoted temporarily to original contributions. The diminished foreign output in psychology, will shorten the general reviews in the BULLETIN for some time and renders this transfer both practicable and desirable. All original contributions should be sent as heretofore to the Editor of the PSYCHOLOGICAL REVIEW. The Board will assign as many articles to the BULLETIN as space permits, subject to the authors' approval.

HOWARD C. WARREN
JAMES R. ANGELL
JOHN B. WATSON
SHEPHERD I. FRANZ

November 10, 1914

